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10 JUN 1958

MEMORANDUM FOR: Deputy Director (Support)

SUBJECT : Electronic Data Processing

This memorandum contains recommendations for approval of the Deputy Director (Support). Such recommendations are presented in paragraph 5 below.

1. PROBLEM:

Is it feasible and advisable for the Machine Records Division (MRD) to perform its work by the use of electronic data processing (EDP) equipment? If so, what type of electronic computer should be installed?

2. ASSUMPTION:

For the purpose of reaching a conclusion regarding the problem questions, this study has been limited to the Offices of Comptroller and Personnel, but it is desirable that it contemplate the possibility of all components, which are or may be served by MRD, receiving the benefits to be derived from a computer installation.

3. FACTS AND DISCUSSION:

a. Data

(1) Facts:

(a) Data, in numerical and alphabetical form, presently originating in the Offices under consideration and necessary for their records and reports consists principally of:

1. Personnel: statistical, historical and qualifying information in respect to each employee, and tables of organization and statistics in respect to groups of employees; extracted from employment resumes, personal histories, and actions affecting transfers, step increases, promotions, separations, etc. From Form 50 alone there are an average of 200 transactions daily.

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2. Comptroller: payroll, leave, general ledger, subsidiary ledgers, allotment, budgetary, financial property and other accounts information; extracted from time and attendance reports, personnel actions, travel vouchers, purchase orders, requisitions, receipts, etc. General ledger transactions alone average 1400 daily.
- (b) 1. Most of this data, after manual preparation, is presently processed on a non-integrated basis by the Machine Records Division (MRD) on electric accounting machinery (EAM), the input to which consists of punched cards. The current status of a record is maintained in a "deck" of punched cards numbering from a few hundred to over 100,000 for a single record. The total of cards in all decks approximates 4,000,000. To up-date these record decks approximately 950,000 cards are processed monthly.
2. Various other records of statistical or historical nature are maintained manually; and much manual work is performed outside of MRD in preparing documents for card punching by MRD.
3. All of the data under consideration could be processed by EDP on an integrated basis.

(2) Discussion:

- (a) Data presently being processed by MRD is distributed by major functions to six organizational branches within MRD, each charged with the responsibility for performing all processing and for producing all reports required by the components it serves. There is very little integration of these data, primarily because of punched card limitations and various procedural problems. Requirements scheduling and cut-off dates frequently create peak loads necessitating overtime operations. Obviously, since each punched card must contain identification and since many records, because of their lengths require multiple cards, there is much duplication of some data. A great amount of sorting, merging, summarizing and combining of cards becomes necessary to maintain the records and produce reports required in varying formats. Because records originate from different sources it is practically impossible, remembering the limitation of a card, to integrate these records into one storage from which any desired item might be extracted.

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- (b) In electronic processing each item of data could be entered into the record storage just once, currently maintained and up-dated, and selected automatically, through proper programming, for production (within the limits of the equipment) in any desired format. In the case of transaction input affecting more than one file or account, each individual record might be up-dated with one punched card. Many records could be maintained on a daily basis making possible the elimination of cut-off dates, peak loads and resulting overtime, and the production of special reports upon demand. Because of such ready demand availability, many periodic reports presently prepared in anticipation of possible need or for manual preparation of summaries could be eliminated. "Decks" of cards would give way to magnetic tape.

b. Costs and Savings:

(1) Facts:

- (a) The annual cost of operating the MRD, not including overhead, using EAM, is approximately \$502,000, including \$22,500 for overtime of personnel. This may be distributed as follows:



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- (b) No estimate of the cost of maintaining records manually or preparing documents for card punching has been made but significant numbers of people are employed in this work, such as:

PI Section, OP
Payroll Branch (Fiscal), Compt
to name a few examples.



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- (c) The study has progressed far enough to indicate savings and reduction of personnel. However, the figures below are necessarily subject to any modification the completed study may produce. The estimated annual cost of operating the MRD, not including overhead, using EDP with IBM 650 or Datatron 220 is:



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- (d) The Bureau of the Budget is concerned about the likelihood of the proselyting of trained EDP personnel as the use of EDP expands. Hence, the Civil Service Commission presently has under consideration the establishment of a proper grade structure for EDP operating and programming personnel. The estimates for personnel costs shown above are based upon available information re present grades in other organizations using EDP. These costs are subject to possible change when firm grades have been established.

(2) Discussion:

- (a) Since it has been impossible to complete full systems studies, the costs presented in (c) above are for maximum EDP equipment considered at this time to be necessary to perform all of the present MRD work in one eight-hour shift. Should the completion of the systems studies indicate that less equipment might be required, any letter of intent could be amended accordingly.
- (b) No meaningful estimate of savings in components outside of MRD can be made at this time. However, EDP will result in the elimination of much manual work now performed in preparation of documents prior to card punching and of summary reports prepared manually. After the computer system has been completely installed and has been in operation for a period of time savings should be substantial.
- (c) No dollar value can be placed upon the better and more timely products that may result from EDP.

c. Equipment

(1) Facts:

- (a) Manufacturers have produced various types of EDP computers for processing data as outlined in paragraph 3.a. above. These computers have been regarded as being divided into three broad classifications, based on purchase prices which are, to some extent, indicative of their processing potentials:
 - 1. Small-scale - under \$100,000
 - 2. Medium-scale - from 100,000 to \$1,000,000
 - 3. Large-scale - over 1,000,000
- (b) The Feasibility Team considered computers in all classifications and conducted exhaustive research into the experiences of many other organizations to determine that a computer of the medium-scale classification would be

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required and would satisfy the demands for processing the data outlined above.

(c) The following five computers were studied in detail:

1. NCR 304
2. Univac File Computer, Model 1
3. Datatron 205
4. IBM 650, with and without RAMAC
5. Datatron 220

The following were eliminated for final consideration for the reasons specified:

1. NCR 304, too expensive and delivery uncertain
2. Univac File Computer, rated 4th in most desirable features
3. Datatron 205, rated 3rd or 4th in three characteristics considered essential
4. IBM 650 RAMAC, no application apparent at this time.

(d) Final consideration was given to the IBM 650 tape system with Read/Write device and off-line Tape-Data-Selector and to the Datatron 220 tape system as two computer systems either of which would satisfy the requirements for processing the data outlined in paragraph 3.a. above. Comparison indicates the great superiority of the 220 over the 650. (See TAB - A)

(e) There are certain "intangible" factors which contribute to the success and growth of a machine installation regardless of the type of EDP equipment used. These factors are:

1. System Service - The service rendered the user by the manufacturer in respect to assistance in designing and installing the system, assistance in programming the applications, training of programmers and machine operators and providing for the education in the field of EDP to other officials in the user Agency.
2. Research and Development - The introduction of new products and the improvement to existing equipment permits the user to improve the operation of his system and expand its use in more fields of work. Basic research leads to better methods and to the solution of problems previously not susceptible to mechanical solution.

3. Range of Products - A wide range of products makes it possible to meet limited requirements with small capacity equipment and to expand the system where greater capacity equipment is needed, without the cost of changing from one make of machine to that of another manufacturer.

(f) EDP equipment may be rented or purchased and a letter of intent will be accepted in lieu of a purchase order to buy or lease. Equipment installed on a leased basis may be discontinued upon 30 days notice. A letter of intent may be withdrawn 90 days prior to delivery of equipment.

(2) Discussion:

(a) Research conducted by the Feasibility Team convinced it that a medium-scale computer having prime features of flexibility, large internal storage, expandable external storage, and adequate speed for input-output, internal operations and file searching would suffice for data processing in the components affected. The IBM 650, with certain added equipment or the Datatron 220 tape systems are the two computers which best satisfy these requirements.

(b) In comparing these two computers the Team considered not only the basic equipment but such additional equipment as might be required to perform the task now apparent, with some allowance for expansion within the area covered by this study. This comparison indicated beyond doubt the superiority of the 220 over the 650 in technical features as disclosed in paragraph 3.c.(1)(d) above.

(c) In considering the intangible factors with respect to:

1. The IBM Corporation: It can be said that, based on over 10 years experience in using IBM products to meet Agency requirements and knowledge of the policies of the IBM Corporation, all of the factors enumerated in 3.c.(e) above are present in their operations and service to customers.

2. The Burroughs Corporation: The Agency has not used their equipment in its accounting work. However, inquiries directed to other users, particularly the Department of the Interior, which made a nation-wide survey of Datatron users, disclosed that support furnished to customers has been excellent. Interviews held with Burroughs officials convinced the Feasibility Team that the Burroughs Corporation is well equipped to render service comparable to that furnished by IBM.

d. Systems Concepts

(1) Facts:

(a) Two systems concepts have been advanced by manufacturers and users with respect to the manner of acquiring a computer.

1. The "building-block" concept under which pieces of computer systems hardware are installed as programs are developed for individual application.

2. The "integrated system" under which all of the computer system hardware is installed at one time for completely integrated programs including all foreseeable applications.

Practically all users favor the "integrated system".

(2) Discussion:

(a) In all of the studies conducted of the Feasibility Team only isolated examples of "building-block" installations were found. The great majority of users, consultants and experts in EDP advocate an integrated system.

(b) In cost, the "building-block" concept would actually be more expensive over a period of time than the "integrated system" concept due to the fact that, until all programs had been placed on the computer, it would be necessary to retain EAM equipment and personnel to operate it. While no dollar cost can be assigned, re-programming old applications to integrate new ones each time one was added would also be much more costly than a completely integrated set of programs from the start, each to be applied as rapidly as feasible.

e. Implementation

(1) Fact:

(a) Manufacturers require lead time of twelve to sixteen months from the date of receiving a letter of intent or order before making delivery of a computer. In order to avoid the loss of this time the Feasibility Team has confined its work to an over-all estimate of EDP requirements so that a letter of intent may be entered at once. Completion of detailed systems studies will be required before taking delivery of any computer.

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(2) Discussion:

- (a) These studies include the completion of procedures analyses, flow charts, block diagramming and computer programming, in order to have an integrated system ready at the time of computer delivery. A year or more may be required to finish this task. Programmers and operators will have to be trained. To assist the Management Staff in this work and to keep the interested offices fully informed with respect to anticipated changes in procedures, T/O's, etc., the continued fine co-operation of these components is necessary. At least one representative from each Office, placed in a position of reporting directly to the head of his component and with responsibility for obtaining concurrences in procedural changes will be essential to complete this work.
- (b) A one-month parallel operation under EAM before discontinuing any present method of processing any record is estimated to be sufficient to prove the efficacy of a computer with respect to such record.

4. CONCLUSIONS:

- a. The application of EDP to the work of MRD is both feasible and advisable.
- b. Significant savings will result from a computer installation.
- c. A Datatron 220 computer will be the best to install.
- d. A fully "integrated" systems concept should be adopted in conjunction with the installation of any computer.
- e. Detailed studies to complete systems analyses and training for programming and computer operation will be required.
- f. In order to retain EDP personnel after training it will be necessary to provide a grade structure comparable with industry and other governmental organizations, and be prepared continually to keep abreast of compensation changes in this field.

5. RECOMMENDATIONS:

It is recommended that:

- a. The Comptroller be authorized and directed to execute a letter of intent to the Electro Data Division of the Burroughs Corporation for installation in early 1959 of a Datatron 220 system on a rental basis (with purchase option).

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- b. The Management Staff be made responsible for directing all studies requisite to such installation, and for making a final recommendation in respect to the letter of intent before the expiration of its withdrawal date (1 March 1959).
- c. The Offices of Personnel and Comptroller each appoint one full-time representative to work in conjunction with the Management Staff in pursuing such studies and to have the responsibility of securing appropriate expedited approval for procedural changes.
- d. The MRD designate personnel to be progressively trained (at least a total of 14), as time will allow during the coming 12 months in programming for and/or operation of the Datatron 220 and to develop, in conjunction with the Management Staff, the essential computer programs.
- (1) To serve this purpose the DD/S provide the Office of Comptroller with 2 ceiling positions for one year if and when the Comptroller's on duty personnel meet his assigned ceiling.
- e. The Office of Personnel institute a study to determine the proper grade structure to be adopted for EDP operating and programming personnel within the Agency.

DDS
approved
2 additional
ceiling slots
1/13/59
until
30 June
1960
GG
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Chief, Management Staff

Attachment:
TAB A

CONCURRENCES:

FOIAb3b

Comptroller

10 June 1958
Date

With respect to recommendations
c. and e:

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Director of Personnel

Date

On 6 June, the D/Pers. advised me on the phone that he has appointed [redacted] to meet C. and accepts e. "of course"

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The recommendations in Paragraph 5 are approved.

FOIAb3b

Date: 21 June 58
L. K. WHITE
Deputy Director
(Support)

T A B - A

COMPARISON OF TECHNICAL FEATURES
IBM 650 and Datatron 220
(Asterisk indicates superiority)

650

220

Central Processing Unit

Arithmetic & Logic Speeds, Per Second
minimum no. of additions or subtractions

minimum no. of multiplications

minimum no. of divisions

minimum no. of logical decisions

Word Size

Memory Size

Average access time

Alphabetic Character Handling

Built-in parity checks

Magnetic Tape System

Reel capacity, useful data

Tape density

Rate of digit transfer

Tape speed, forward read/write

Tape speed, backward read

Tape speed rewind

Tape record size

Independent search, on line

Independent scan, on line

Variable Record size

Read/write same tape

Concurrent read/write

Maximum no. of tape units

Tape off-line operations (available at extra cost)

InPut - OutPut Punch Card Devices

Maximum no. on line with computer

Can be operated independently

No. of basic input card formats

No. of basic output card formats

Individual input/output at same time

1,300

84

62

2,300

10 digits / sign

2000 words max.

.0024 sec.

requires spec. devices at increased cost

Yes

5,400

290

150

8,000

10 digits / sign

* 2000 words min.

10,000 words max.

* .000010 sec.

* Built into basic system

Yes

4,608,000 digits

200 digits per in.

15,000 per sec.

75 in. per sec.

None

* 500 in. per sec.

1 to 60 words

No

NO

Yes (limited

No

Not part of basic system, but available at increased cost

6 basic-10

available with concurrent read/write

* searching, scanning, printing & punching

* 13,672,000 digits

* 416 digits per in.

* 25,000 per sec.

* 120 in. per sec.

* 120 in. per sec.

120 in. per sec.

* 10 to 100 words

* Yes

* Yes

* Yes

* Yes

No

* 10

None

* 7

Yes

* 6

* 5

No

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650

220

Paper Tape System

Maximum no. of paper tape readers	Not standard	*	10
Speed of paper tape readers	Unknown	-	1000 char. per sec.
Maximum no. of paper tape punches	None	*	10
Speed of paper tape punches	None	-	60 char. per sec.

Inquiry Facilities

Maximum no. of supervisory printers	None	*	10
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NOTE: Items marked # have been included in the total estimated cost of the IBM 650 shown in paragraph 2.b. (3) above but their addition still does not make the 650 the equal of the 220

Expansion possibilities not included above are: IBM 650 - Up to 4 RAMAC units with random access storage per unit of and (with RAMAC) supervisory printers

6,000,000 digits
10

Datatron 220 - Up to 10 Data file units with random access storage per unit of

* 50,000,000 digits

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7/18/58

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1959 Revised reports.

1959

Received 2 people (9/11)

07	<u>50,000</u>	Installation of Datatronics 220 system
	<u>39,000</u>	space, freight etc
03	3,000	freight - transp - Datatronics
02	3,000	Travel to
05	9,000	Rental for $\frac{1}{2}$ mo for ^{electronic} Computer
08	4,000	Supplies & formal memory for Datatronics 220 system
09	1,000	Equipment (additional port etc)
	<u>59,000</u>	

1,000 Travel for officials of MRP to Osenda?

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7/10/58

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MRB- 1959 Revised reports.1959

Salaries of 2 people

(9#11)

07.	<u>50,000</u>	Installation of Datatronics 220 system
	<u>39,100</u>	space, freight etc
03	3,000	freight - transp - Datatronics
02	3,000	Travel to
05	9,000	Rental for $\frac{1}{2}$ mo for ^{electronic} Computer
08	4,000	Supplies & formal memory for Datatronics
09	1,000	Equipment (additional port etc)
	<u><u>\$59,000</u></u>	

1,000 Travel for officials of MRB to Puerto Rico?

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36	12	12
109	18	36
	18	18
		216 ⁰⁰⁰

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05

\$ 325 800 -

4 mos rental current
(Reduction 7700) 2 months
5th. may
new rental for Dalmian

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